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Structure and Function of the Cow's Udder

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Structure and Function of the Cow's Udder

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Most dairy cows efficiently convert feed into milk. The focal point in this process is the udder or mammary gland. Originally the cow secreted enough milk to nourish the young. Over a very long time, improved selection and feeding have resulted in increased milk production and greater development of the mammary gland. Increased knowledge of the structure, growth and function of the udder should help dairy farmers take better care of their cows and obtain increased returns.

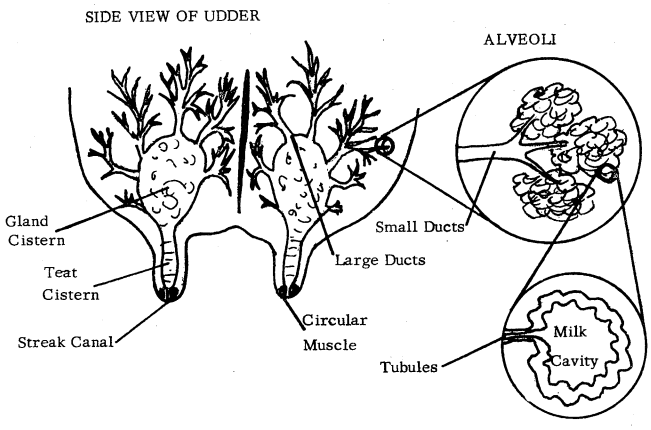
Composition of the Udder

The cow's udder consists of four glands which are grouped together--two on each side--to form halves. It varies in weight after milking from less than 10 to more than 150 pounds. The udder is attached to the body by median and lateral supporting ligaments. The median suspensory ligament is composed of fibers that come out of the lower abdominal wall and spread into each half of the udder. It is elastic and stretches to allow the udder volume to change with minimum lowering of the udder floor. The lateral suspensory ligaments are composed of inelastic tissue and cover the upper outer surface of the udder. If the median suspensory ligament does not have sufficient strength, the udder is said to be breaking away. This condition usually results in longer and more difficult milking and greater chance of injury.

Each quarter functions independently and has its own outlet, the teat. At the lower end of the teat is an opening made up of a streak canal surrounded by a circular muscle. If this muscle is strong and the streak canal is narrow, the cow is a hard milker. If it is relatively weak and wide, she is an easy milker. The teat cistern holds about 1 ounce of milk and it connects to the gland cistern that varies considerably in size and shape. The gland cistern usually holds about 16 ounces of milk and has 8-12 large ducts emptying into it.

Where Milk is Manufactured

The large milk ducts branch and rebranch into collecting tubules that begin at each alveolus, which is the basic milk-producing unit in the udder. These microscopic alveoli are so numerous in the more highly efficient glands that they occupy practically all the available space. After udders of this type are milked out, they seem to "shrink away" to nothing and are free of excessive connective tissue. Other necessary internal structures of the udder include the blood supply, supporting tissue, the lymphatic system and nervous tissue.



Dairy Section • Animal Sciences Department

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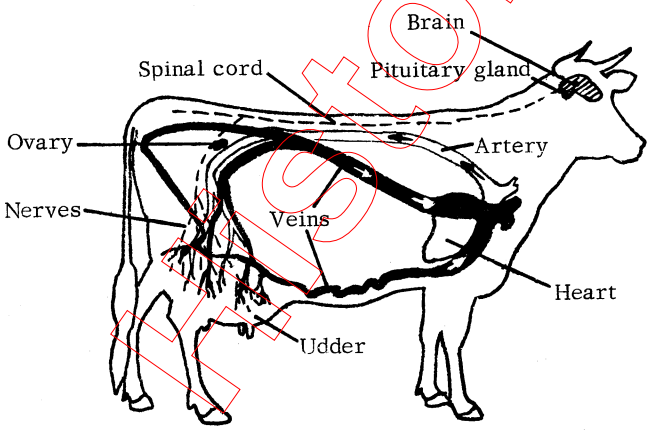
Milk is manufactured in each alveoli and stored between milkings mainly in the milk cavity, tubules and small ducts. The raw materials for milk are transported to the alveoli by the blood. These alveolar cells then change them into milk fat, milk sugar and milk protein. Much is still to be learned about the complicated mechanisms involved in the synthesis of milk.

Mammary gland growth and function is controlled by many hormones. Estrogens, from the time of the first heat period, stimulate growth of the mammary duct system while progesterone, after pregnancy, causes the formation of alveoli. These hormones are produced by the ovaries. The fully developed udder does not secrete milk unless a hormone known as prolactin (produced by the pituitary gland) is present. Once milk synthesis is started, the continuous secretion of several hormones by the pituitary is necessary to maintain lactation. Feeding a balanced ration also is important in maintaining production.

Milk Let-Down

Milk let-down results from the cow's response to a sensory stimulus. The sensory nerves of the eye, ear, nose and mammary gland operating through a conditioned reflex cause the posterior pituitary to release oxytocin. It is carried by the blood to the udder and causes the muscle-like fibers surrounding the alveoli and ducts to contract and force the milk into the larger ducts and gland cistern. Only after milk let-down can normal milking effectively remove the milk from the udder. Since the effect of oxytocin only lasts for about ten minutes, it is important to milk rapidly to remove most of the milk present in the udder.



Nerves, hormones and blood system work together to cause milk let-down.

It is important to relieve udder pressure at regular intervals through proper stimulation of milk let-down and prompt milking. Milk secretion is continuous but the rate of secretion decreases as the udder pressure increases. In high producing cows the udder pressure may build up and stop further gain in milk after 8 to 10 hours. In most cows, however, this does not occur for 16 to 20 hours. During normal milking most of the milk (approximately 80 percent) is removed from the udder. The amount remaining is trapped in the small ducts and tubules of the udder and will be obtained at a later milking. Excessive milk left in the udder allows intramammary pressure to build up more rapidly between milkings and contributes to the drying-off of the milk secreting cells of the udder.

Stimulation Necessary

The stimulus of the milking act itself is also partially responsible for the maintenance of lactation; therefore, dairymen should insure adequate but gentle washing and stimulation of the cow's udder and prompt application of the milking machine (usually within one minute). Care should also be taken to minimize unfavorable stimulation (don't frighten or hit her) that may upset the emotional status of the cow which will interfere with her let-down of milk.

After a normal lactation, a cow is dried-off to allow rest and regeneration in preparation for another lactation. The most efficient and least harmful way to dry-off the healthy udder is to suddenly and completely stop milking. This should be followed by daily palpation of the udder for 7 to 10 days to insure that drying up proceeds normally. This method enables a cow to quickly convert the milk in her udder into a blood serum-like fluid that is better able to combat bacterial infection. Partial or intermittent milking only prolongs the time needed for this change to occur.

Summary

1. Knowledge of the structure, growth and function of the udder should help dairy farmers take better care of their cows and obtain increased returns.

2. Milk secretion is a continuous process that is mainly under hormonal control.

3. Milk let-down is a positive act on the part of the cow. She can be trained to respond promptly and completely by correct milking methods and procedures.

4. Milking should be rapid to insure removal of the maximum amount of milk. Once the hormone, oxytocin, has been released into the blood, it will be effective for about 10 minutes.

5. Cows generally respond to kind treatment. The man operating the milking machine develops good or bad milking habits in the herd.

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